

of bathyal or abyssal origin. In any case the algae and radiolaria inhabited the photic zone, but in view of presumed allochthonous origin of the organic matter, no clear-cut case can be made here for shallow water (neritic) accumulation of the shales.

The character of the nodules and unusual preservation of their organic contents calls to mind the remarkable coal balls of the Carboniferous, though processes involved in formation of the latter may be quite different.

ZOOLOGY.—*Two new species of amphipod crustaceans from the east coast of the United States.*¹ CLARENCE R. SHOEMAKER, United States National Museum. (Communicated by MARY J. RATHBUN.)

In November, 1937, a collection of amphipods taken at the Isles of Shoals, New Hampshire, by Mr. James A. Williams, was sent by him to the U. S. National Museum for identification. The collection for the most part contained only well known New England forms, but two, *Pontharpinia epistoma* and *Gammarus greenfieldi*, were recognized as being new to science. A number of specimens of *Pontharpinia epistoma* are in the National Museum collection, but these whenever identified, had been assigned to *Paraphoxus spinosus* Holmes, which they superficially much resemble. *Gammarus greenfieldi* is a very abundant littoral form occurring on the coast of Massachusetts and extending northward at least as far as Frenchmans Bay, Maine. It is surprising that such a conspicuous common littoral New England form should have remained unnoticed for so long a time.

Pontharpinia epistoma n. sp.

Fig. 1

Diagnosis.—Gnathopods with sixth joint distally very broad and palms only slightly oblique. Fourth side-plate with hind excavation very shallow. Fifth pereopod with hind margin of second joint plainly serrate. Third metasome segment with lower margin evenly convex and with a scarcely perceptible hind angle, hind margin with only a few long, closely set spines on lower part, above which it is convex.

Male.—Head, rostrum reaching to about the middle of the second peduncular joint of antenna 1, apex broadly rounding. Eye large, oval, brownish. Antenna 1, first and second peduncular joints equal in length, third joint very short; flagellum shorter than peduncle and composed of about nine joints which bear calceoli; accessory flagellum not much shorter than the primary and composed of about eight joints. Antenna 2 as long as the entire body, fourth and fifth peduncular joints equal in length; flagellum very long and slender and bearing a calceolus on every other joint. Epistome project-

¹ Published by permission of the Secretary of the Smithsonian Institution. Received April 20, 1938.

ing forward, prominent, conical, and rather sharply pointed. In many specimens the epistome is not so prominent as in the specimen figured. Mandible with apparently five spines in spine-row; second and third joints of palp about equal in length. Maxilla 1, inner plate very well developed, with perhaps three short apical spines and a few marginal setules; outer plate with eleven spine-teeth which may be slightly serrate; palp two-jointed and bearing six apical spines. Maxilla 2 with inner and outer plates about equal in size and shape. Maxillipeds, inner plate broader than outer and bearing distally one spine and several spinules; outer plate short, reaching to about the end of first joint of palp and bearing a few spines on inner margin; fourth joint of palp very slender, curved and bearing a minute spinule on inner margin near apex.

Side-plates 1 to 4 bearing a few setae on lower margin, fourth very slightly excavate behind, fifth bilobed with front lobe shallower than hind lobe. Gnathopods about alike in size and shape; sixth joint rather short, and widening very much distally; palm only slightly oblique, and defined by a rounding projection of the hind margin of sixth joint. First and second peraeopods about alike in size and shape; the form and armature of these, as also of peraeopod 3, 4, and 5, are accurately shown in the accompanying figures of these appendages.

Pleon segment 1 rather evenly rounding below. Segment 2 broader below than either 1 or 3, a row of plumose setae near lower margin which is slightly concave toward the rear margin. Segment 3 with very slight lower hind angle, lower margin convex and bearing a row of slender marginal spines above which in the largest specimens are a few scattered spines, lower hind margin straight for a short distance and bearing a row of long slender closely-set spines above which the margin is convex. This hind margin is subject to considerable variation; in some specimens the convexity is very pronounced, while in others it is scarcely perceptible. Urosome slender. Uropods slender and rather sparsely spinose; but in the largest specimens they are stouter and more spinose. Uropod 1, peduncle bearing a few spines on the upper inner and outer margins, and a conspicuous spine on the inside distal end; outer ramus with three marginal spines and inner with two above and one slender spine projecting down from lower margin. In the largest specimens there are fewer peduncular spines, the large inside spine is absent and the spines of the rami are grouped closer together and are nearer the peduncle. Uropod 2, peduncle with a few marginal spines; outer ramus with two marginal spines and inner with one. In the largest specimens the peduncular spines are longer and the two or three proximal ones are conspicuously long and slender, the outer ramus with three spines and the inner with two. The spination of the pleon segments and the uropods is thus seen to vary with age, and even in the largest specimens the number of spines is not constant. Telson bearing two setae on either lateral margin, and two small spines on the apex of either lobe. Length of the largest males about 6 mm.

Type.—A male specimen taken by the U. S. Fisheries steamer *Albatross* at the surface off Block Island, Rhode Island, July 8, 1883, U. S. Nat. Mus. no. 75671.

Female.—The female is stouter and much broader than the male. The eyes are small, nearly round, and brownish. Antenna 2 not much longer than 1. The remaining appendages are very much like those of the male, except the third uropods, which show the sexual modification usual in the genus *Pontharpinia*. Uropod 3 of the female is shown in fig. 1*r*. Length of the largest females about 7 mm.



Fig. 1.—*Pontharpinia epistoma*, new species, male. a, Anterior end; b, posterior end; c, mandible; d, maxilla 1; e, maxilla 2; f, maxilliped; g, lower lip; h, epistome and upper lip; i, j, gnathopods 1 and 2; k, end of peraeopod 1; l, peraeopod 2; m, n, o, peraeopods 3, 4, and 5; p, uropod 1, inside; q, uropod 3; r, uropod 3, female; s, telson; t, u, uropods 1 and 2 of a larger male.

This species has been confused with Holmes' species *Paraphoxus spinosus* which it superficially resembles. I have examined the mouth-parts of *Paraphoxus spinosus* and find that the first maxilla has a two-jointed palp, so this character, together with the strongly expanded fourth joint of peraeopods 3 and 4, places it in the genus *Pontharpinia*. *P. epistoma* can be distinguished from *P. spinosa* by the more expanded sixth joint of the gnathopods and the less oblique palms. In *P. epistoma* the serrations on the rear margin of the second joint of the fifth peraeopod are very prominent, while in *P. spinosa* they are scarcely perceptible. In *P. epistoma* the lower margin of the third pleon segment is convex and bears marginal spines, but in *P. spinosus* this margin is straight or slightly concave and is without spines.

Stebbing, in his diagnosis of the family Phoxocephalidae (Das Tierreich, I. Gammaridea, p. 133) says, "epistome not projecting," but *P. epistoma* has a well-developed forward-projecting epistome, fig. 1 h.

There are specimens of *Pontharpinia epistoma* in the U. S. National Museum collection from Isles of Shoals, New Hampshire; Narragansett Bay, Rhode Island; Block Island, Rhode Island; Long Island Sound, and Gardiner's Bay, Long Island; off Martha's Vineyard, Massachusetts; off Broadkill, Delaware; *Albatross* station 2312, off Charleston, South Carolina; and west end of Skull Creek, South Carolina.

Gammarus (Marinogammarus) greenfieldi, n. sp. Fig. 2

Diagnosis.—The corners of the side lobes of head rounding. The lower hind corner of the second joint of peraeopods 3–5 forming a prominent angle which is rounding in peraeopod 3 and square in 4 and 5. Third metasome segment with lower hind angle square and not produced. Uropod 3 with inner ramus well developed and nearly half the length of the outer which is one-jointed and very setose. Telson bearing a conspicuous group of spines on lateral margins.

Male.—Head about as long as the first plus one-half of the second mesosome segment; side-lobes not much protruding, with upper and lower corners rounding. Eye reniform, rather long and narrow, black. Antenna 1 longer than 2; first joint about one-fourth longer than second, which is nearly twice as long as third; flagellum composed of about forty joints. Antenna 2, fourth joint slightly shorter than fifth; flagellum about equal in length to the peduncle; upper and lower margins of peduncle and flagellum furnished with groups of setae, a few of which are sparsely plumose.

Upper lip evenly convex on lower margin, and lateral lobe on right side rather prominent. Right mandible, molar prominent and bearing a seta on hind margin; cutting-edge narrow and bearing three teeth; accessory plate with double serrate cutting edge; five spines in spine-row; second joint of palp longest and bearing spines on outer edge; third joint about three-fourths as long as second and bearing a comb of very fine spines on outer margin, and a group of spines on inner and outer surface. Maxilla 1, right, inner plate with lateral margin spinose throughout; outer plate bearing eleven serrate spine-teeth; palp with the obliquely truncate distal margin bearing five short teeth and two setae. Maxilla 2, outer plate with distal spines only; inner plate with spines on inner margin and apex, and an oblique row of plumose spines near inner margin. Lower lip with inner lobes



Fig. 2.—*Gammarus (Marinogammarus) greenfieldi*, new species, male. *a*, Anterior end; *b*, posterior end; *c*, mandible; *d*, maxilla 1; *e*, maxilla 2; *f*, maxilliped; *g*, *h*, upper and lower lips; *i*, *j*, gnathopods 1 and 2, inner side, showing the spine arrangement; *k*, *l*, *m*, peraeopods 3, 4, and 5; *n*, end of peraeopod 5; *o*, uropod 1; *p*, uropod 3; *q*, telson. Female. *r*, *s*, gnathopod 1; *t*, gnathopod 2; *u*, *v*, gnathopods 1 and 2, showing spine arrangement.

not perceptible. Maxilliped with inner plate reaching to about the middle of first joint of palp, armed distally with three spine-teeth and a row of spines which is continued down the inner margin; outer plate reaching to about the middle of the second joint of the palp, armed distally with long, curved spines and along the upper half of the inner edge with spine-teeth; palp well developed, outer margin of third joint produced into a short lobe whose inner margin extends obliquely down the inside of the joint and is furnished with a row of long setae; dactyl well developed and bearing a sharp nail at the base of which is a short setule.

Side-plates 1-3 deeper than broad, lower margin broadly rounding, and bearing a spinule at the junction with the hind margin; side-plate 4 as broad as deep, rear margin excavate, rear lobe without spinules; side-plates 5 and 6 with shallow front lobe. Gnathopod 1, fifth joint four-fifths as long as sixth, sixth joint with palm very oblique and passing imperceptibly into the hind margin, but defined by one long and one short spine against which the dactyl closes, a stout spine in center of palm, and several short, blunt spines, some of which are curved, situated on inside of joint in the vicinity of the defining spines; dactyl curved, not fitting palm, but apex only resting against palm. Gnathopod 2 larger than gnathopod 1, fifth joint three-fourths as long and not as wide as sixth, sixth joint widest distally, palm oblique and passing into the hind margin by a rounding curve, but defined by a long spine just beyond which is a shorter one, a stout spine on the outside at the center of the palm and another on the outside near the defining spine, three spines on inside opposite the defining spine.

Peraeopods 1 and 2 about equal in length; dactyls rather short and stout, and bearing a well-defined nail, inside margin bearing a seta just before the nail, and the nail bearing a seta on the outside at its base. Peraeopods 3-5 increasing in length consecutively, though 5 is only slightly longer than 4, second joints moderately expanded with lower hind corner forming a decided angle, which is rounding in peraeopod 3 and square in 4 and 5; dactyls like those of peraeopods 1 and 2 except that the seta at the base of the nail is on the inside, owing to the turning forward of the limb.

Metasome segments 2 and 3 with lower hind corner quadrate, not produced, lower margin with two spines, but frequently with only one or none at all. Urosome segments 1 and 2 very slightly raised dorsally. The dorsal spine arrangement of the ural segments is quite variable, but the most frequent arrangement appears to be: segment 1, a pair of spines on either side of the median line near the center and one spine on either side of the median line at the rear margin, and three lateral spines obliquely placed on either side; segment 2, a pair of spines on either side of the median line near the center, one spine centrally placed on rear margin and three lateral spines obliquely placed on either side; segment 3, one spine on either side of the median line near rear margin and two lateral spines on either side, no rear marginal spines. Segment 1 has also a spine at the lower lateral corner at the base of uropod 1.

Uropod 1 extending farther back than 2; peduncle, besides the upper marginal and distal spines, has a prominent spine at the lower margin near its base; rami subequal and about two-thirds the length of the peduncle. Uropod 2, peduncle with three or four spines on upper, outer margin, inner ramus longer than outer and about equal in length to the peduncle. Uropod 3 extending much beyond 1 and 2; outer ramus about two and one-half times the length of the peduncle and consisting of only one joint; inner ramus very nearly one-half the length of the outer; outer ramus bearing groups of

spines and setae on outer and inner margins and apex, but the spines on inner margin confined to the upper half; apex bearing four spines; inner ramus bearing spines and setae only on the inner margin and apex. All the setae of uropod 3 are simple and not plumose. Telson as broad as long, cleft nearly to base and reaching to about the end of the peduncle of uropod 3, a group of three spines at the center of the lateral margins and three spines and a few setae on the apex of each lobe. Length, 19 mm.

Type.—A male collected by Mr. Ray Greenfield from a small pool at Pebbly Beach, near Gloucester, Massachusetts, June 20, 1929. U. S. Nat. Mus. no. 75670.

Female.—Like the male in general, but smaller, Gnathopod 1 with fifth and sixth joints shorter than in the male, palm oblique, passing into the hind margin by a rounding curve, and defined on the outside by a spine beyond which are two smaller spines; on the inside, opposite the longer defining spine, is a spine at the base of which are two smaller ones. Gnathopod 2 slender than in the male; fifth joint as long as or a little longer than sixth; sixth joint widest in the middle, at which point it is as wide as the fifth, palm less oblique than in the male, evenly convex and passing into the hind margin by a rounding curve, defined by a spine beyond which is a shorter spine and several slender spinules, a pair of spines on inside of palm opposite the shorter outer spine, no spine in center of palm. Length, 15 mm.

This species belongs to the new subgenus *Marinogammarus*, recently created by Dr. A. Schellenberg.² This subgenus contained only two species, *G. marinus*, known from Europe as far north as the White Sea, British Isles, Farøe Islands, and the northeast coast of the United States, and *G. locustoides*, known from the northwest coast of North America and the northeast coast of Asia. The present species differs from the other two by the absence of the second joint to the outer ramus of uropod 3, and by the presence of a very well defined lower anterior angle to the second joint of pereopods 3-5. In *G. marinus* the outer ramus of uropod 3 possesses a very well developed second joint, and in *G. locustoides* the second joint is very small and inconspicuous, but in *G. greenfieldi* the second joint is entirely absent.

Mr. Ray Greenfield, while visiting the Massachusetts coast near Gloucester during the summer of 1929, found this amphipod to be a very abundant inhabitant of the intertidal zone and rock pools left by the receding tide. He made a very fine collection, including individuals of all sizes, for the the National Museum, and I am therefore naming this species for him.

There are in the National Museum collection specimens of *Gammarus greenfieldi* from Frenchman's Bay, and Heron Island, Lincoln County, Maine; Rye Beach and Isles of Shoals, New Hampshire; Gloucester and Cohasset, Massachusetts.

² Zoologischer Anzeiger, Bd. 117, heft 11/12, p. 270. 1937.